

DUPLICATE

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1 Insect Repellent

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3 The present invention relates to an insect repellent.
4 More particularly the present invention relates to a
5 composition, which can be applied to the skin in order to
6 repel insects including, but not limited to mosquitoes
7 and midges.

8

9 In a number of European countries including the UK, and
10 particularly Scotland, the midge and horsefly are serious
11 irritants, to tourists, gardeners and sports enthusiasts,
12 such as ramblers, hill-walkers, climbers, etc. It is
13 estimated that around 14,000 species of midge exist, some
14 of which carry viruses which are known to be dangerous to
15 animals. Whilst in general, midge bites are not
16 particularly dangerous and rarely result in disease in
17 humans, the bites can be unpleasant and cause pruritis
18 (itching), urticaria (skin eruptions) and localised
19 inflammation. Unfortunately, it is thought that the
20 prevalence of these pests may increase as worldwide
21 climate changes occur.

22

1 The common midge and fly are irritating but generally
2 harmless pests. However in many countries serious and
3 potentially fatal diseases are spread by insects, such as
4 mosquitoes. For example, the mosquito-borne illness,
5 malaria, is one of the main killer diseases of the world,
6 and causes an estimated 1 to 2 million deaths per year.
7 In addition mosquito-borne illnesses are estimated to be
8 transmitted to more than 700 million people annually.
9 In some parts of Africa it is estimated that 10% of the
10 total mortality of infants under the age of 5 is due
11 directly to the disease. Although historically this
12 serious illness was localised in tropical areas such as
13 Central and South America, the Middle East, the Indian
14 sub-continent and Asia, the prevalence of malaria is
15 rising due to temporary migration of the population
16 between these countries, primarily due to the increase in
17 popularity of tropical destinations for holidays and
18 vacations. This is exemplified in the UK, where the
19 number of reported cases of malaria has increased
20 dramatically in recent decades due to foreign travel.
21 Although malaria can be cured with prescription drugs,
22 many mosquito species have developed resistance to common
23 anti-malarial drugs. Therefore, as with many insect
24 borne illnesses, prophylaxis is seen as preferable to
25 cure. This is generally achieved through a combination
26 of vaccination and also by the prevention of bites in the
27 first instance.

28

29 Other diseases spread by insects, include the viral
30 illnesses Yellow Fever, Dengue Fever, Encephalitis and
31 Filariasis which are all mosquito-borne. For the
32 majority of these illnesses there are no preventative
33 vaccines, and often no specific treatment. Thus the

1 essence of prevention is to avoid being bitten in the
2 first place and protection from arthropod bites is
3 paramount in ensuring a reduction in insect-borne
4 disease. For example at present there is no effective
5 drug treatment for Yellow Fever or Encephalitis, and
6 therefore prophylaxis is essential. Yet further, there
7 is no current effective vaccination for Dengue Fever, and
8 therefore it is vitally important that the initial insect
9 bite is avoided.

10

11 Other insect-borne diseases include leishmaniasis which
12 is transmitted by sandflies; sleeping sickness
13 transmitted by the tsetse fly; lyme disease and typhus
14 fever which are transmitted by ticks.

15

16 The demand for suitable insect repellents is therefore at
17 an all-time high. There are many well known insect
18 repellents on the market. Historically, most include the
19 chemical DEET (N,N diethyl-3-methylbenzamide) or DEET
20 derivatives. The efficacy of DEET in repelling biting
21 insects has so far not been matched by any other natural
22 or synthetic product since being introduced in 1975. It
23 is estimated that 38% of the American population, and
24 over 200 million people worldwide, use DEET preparations
25 every year. However, whilst this chemical has been
26 proven to be highly effective in repelling insects, it is
27 highly toxic and can be absorbed through the skin. The
28 toxicity, due to the pharmacokinetics of the chemical,
29 has resulted in a catalogue of reported minor to serious
30 adverse effects in use. Heavy exposure to the chemical
31 is known to induce memory loss, weakness, headache,
32 fatigue, muscle and joint pain tremors and shortness of
33 breath. Yet further, DEET can act as a skin irritant and

1 has a disagreeable odour. In addition, care must be
2 taken to avoid furnishings, plastic, varnished and
3 painted surfaces, when using repellents containing this
4 chemical. Accordingly, in recent years there has been a
5 move towards the search for natural, non-toxic yeast
6 effective insect repellents, which do not cause
7 irritation or toxicity to the user.

8
9 It is an object of the present invention to provide a
10 natural insect repellent, which is non-toxic to the user.

11
12 Yet further, it is an object of the present invention to
13 provide a natural insect repellent, which is non-irritant
14 and has a pleasant smell.

15
16 It is a further aim of the present invention to provide
17 an insect repellent, which is effective against insects
18 such as fleas, ticks, gnats and, in particular, midges
19 and mosquitoes.

20
21 According to a first aspect of the present invention,
22 there is provided a composition, which is effective in
23 repelling insects, comprising a mixture of essential oils
24 in a carrier oil.

25
26 Preferably the essential oils are lime oil, myrtle,
27 citronella oil, eucalyptus oil and neem oil.

28
29 In a preferred embodiment, the carrier oil is grape seed
30 oil. However, other carrier oils may be used, including
31 almond oil, avocado oil, vegetable oil, wheat flour oil
32 or sunflower oil, soya oil or a mixture thereof.

33

1 Preferably the carrier oil constitutes in the region of
2 50% of the composition.

3

4 Preferably the essential oils constitutes in the region
5 of 50% of the composition.

6

7 Preferably the neem oil is present in a concentration of
8 between 740 and 760 drops per 37ml of the composition.

9

10 Most preferably the neem oil is present in a
11 concentration of 750 drops per 37 ml of the composition.

12

13 Most preferably the myrtle is bog myrtle.

14

15 The neem oil may be in the form of an extract of the
16 Indian Neem tree *Azadirachta Indica*.

17

18 Preferably the lime oil is present in a concentration of
19 between 8 and 12 drops per $\frac{1}{2}$ ml of the composition.

20

21 Most preferably the lime oil is present in a
22 concentration of 10 drops per $\frac{1}{2}$ ml of the composition.

23

24 Preferably the myrtle oil is present in a concentration
25 of between 28 and 32 drops per $1\frac{1}{2}$ ml of the composition.

26

27 Most preferably the myrtle oil is present in a
28 concentration of 30 drops per $1\frac{1}{2}$ ml of the composition.

29

30 Preferably the citronella oil is present in a
31 concentration of between 190 and 210 drops per 10ml of
32 the composition.

33

1 Most preferably the citronella oil is present in a
2 concentration of 200 drops per 10 ml of the composition.

3

4 Preferably the eucalyptus oil is present in a
5 concentration of 3 to 7 drops per $\frac{1}{4}$ ml of the composition.

6

7 Most preferably the eucalyptus oil is present in a
8 concentration of 5 drops per $\frac{1}{4}$ ml of the composition.

9

10 Optionally the composition is provided as a spray.

11

12 The composition is intended for topical use.

13

14 The composition is suitable for use on humans and
15 animals.

16

17 The composition repels insects including, but not limited
18 to midges, mosquitoes, gnats, ticks, flies and fleas.

19

20 Preferably the composition has a pleasant odour.

21

22 According to a second aspect of the present invention,
23 there is provided a composition, which is effective in
24 repelling insects, comprising a mixture of lime oil,
25 myrtle, citronella oil, eucalyptus oil and neem oil.

26

27 Most preferably the myrtle is bog myrtle.

28

29 Preferably the essential oils constitutes in the region
30 of 50% of the composition.

31

32 Preferably the lime oil is present in a concentration of
33 between 8 and 12 drops per $\frac{1}{4}$ ml of the composition.

1

2 Most preferably the lime oil is present in a
3 concentration of 10 drops per $\frac{1}{2}$ ml of the composition.

4

5 Preferably the myrtle oil is present in a concentration
6 of between 28 and 32 drops per $1\frac{1}{2}$ ml of the composition.

7

8 Most preferably the myrtle oil is present in a
9 concentration of 30 drops per $1\frac{1}{2}$ ml of the composition.

10

11 Preferably the citronella oil is present in a
12 concentration of between 190 and 210 drops per 10ml of
13 the composition.

14

15 Most preferably the citronella oil is present in a
16 concentration of 200 drops per 10 ml of the composition.

17

18 Preferably the eucalyptus oil is present in a
19 concentration of 3 to 7 drops per $\frac{1}{4}$ ml of the composition.

20

21 Most preferably the eucalyptus oil is present in a
22 concentration of 5 drops per $\frac{1}{4}$ ml of the composition.

23

24 The neem oil comprises the remainder of the composition
25 and acts as a carrier oil.

26

27 Optionally the composition is provided as a spray.

28

29 The composition is intended for topical use.

30

31 The composition repels insects including, but not limited
32 to midges, mosquitoes, gnats, ticks, flies and fleas.

33

1 Preferably the composition has a pleasant odour.

2

3 According to the third aspect of the present invention,
4 there is provided a composition, which is effective in
5 repelling insects, comprising a mixture of essential oils
6 and a base cream.

7

8 Preferably the essential oils are lime oil, myrtle,
9 citronella oil, eucalyptus oil and neem oil.

10

11 Most preferably the myrtle is bog myrtle.

12

13 Optionally the composition comprises a carrier oil which
14 may be grape seed oil, however other carrier oils may be
15 used, including almond oil, avocado oil, vegetable oil,
16 wheat flour oil or sunflower oil, soya oil or a mixture
17 thereof.

18

19 Typically the base cream comprises a mixture of aqua,
20 prunus dulcis, glycerine (vegetable), cetearyl alcohol,
21 stearic acid, triethanolamine, ceteareth 20, methyl
22 paraffin, imidazolidinyl urea and propyl paraffin.

23

24 The composition is intended for topical use.

25

26 Preferably the composition has a pleasant odour.

27

28 Advantageously, the described composition has an
29 agreeable smell, and is completely natural and non-toxic
30 to the user.

31

32 In the present invention, it has been discovered that the
33 described composition has surprisingly superior and

1 super-additive effectiveness over conventional insect
2 repellents in repelling midges and mosquitoes.
3 Specifically, it has been discovered that by preparing a
4 composition comprising 10 drops per $\frac{1}{2}$ ml of lime oil, 30
5 drops per $1\frac{1}{2}$ ml of bog myrtle, 200 drops per 10 ml of
6 citronella oil, 5 drops per $\frac{1}{4}$ ml of eucalyptus oil and
7 740 drops per 37 ml of neem oil, preferably with a
8 carrier oil results in a superior non-toxic insect
9 repellent.

10

11 It is well known in the field of aromatherapy to refer to
12 quantities of essential oils in the form of "drops per
13 ml". Generally 20 drops is equivalent to 1ml of
14 essential oil, although the important concept is the
15 quantity of the essential oil relative to the carrier
16 oil, or other oils, as opposed to the exact quantity
17 used.

18

19 In the preferred embodiment, grape seed oil is used as a
20 carrier, however it will be appreciated that any suitable
21 natural oil, such as almond oil, avocado oil, vegetable
22 oil, wheat flour oil or sunflower oil, soya oil or indeed
23 a mixture thereof could be used.

24

25 It is also appreciated that any form of eucalyptus, such
26 as lavender eucalyptus or lemon eucalyptus could be used
27 within the composition. Similarly, whilst the use of bog
28 myrtle is preferred, any alternative and corresponding
29 type of myrtle, such as white myrtle, could be used.

30

31 In an alternative embodiment, the carrier oil could be
32 removed altogether, and the neem oil could be substituted
33 as the carrier base.

1

2 The composition can be provided in the form of a spray or
3 a topical cream or ointment.

4

5 The effectiveness of the composition described in the
6 present Application has been tested in the laboratory.
7 Comparative tests were carried out with 14 volunteers
8 using an arm in cage technique with adult laboratory
9 reared *Aedes Aegypti* (Cuculidau) insects. In this
10 technique an area of skin (in this case the hand/arm) is
11 coated with the composition being tested and then exposed
12 to the insects (typically around 20 insects) within an
13 enclosure for a set, standard period of time. The
14 enclosures were thick plastic cylinders with a resealable
15 opening at one end, into which a volunteers hand could be
16 placed. All areas of the enclosure were viewable from
17 the outside. The insects used, were chosen primarily due
18 to their prevalence in tropical and subtropical regions.
19 The species is a notorious insect vector. In addition
20 this species is relatively large in size which
21 facilitated observation regarding their movement and
22 behavioural response to the various repellents during the
23 tests. Effectiveness was calculated by two means,
24 firstly by visual observation of the number of mosquitoes
25 which land on the tester's hands, and secondly by
26 counting of the number of visible bites which appear at
27 the end of the test.

28

29 The volunteers were selected to representative of varying
30 age groups and consisted of 6 males and 8 females.
31 Repellency was calculated by measuring the landing rates
32 of the insects. Specifically the percentage decline of
33 mosquitoes landing within a predetermined area of skin

1 was used as a measure of repellency efficacy. Each
2 volunteer first undertook a control test by placing their
3 untreated arm into the enclosure containing a mixed
4 population of the mosquitoes. Both left and right hands
5 were used. The volunteers wore protective gloves with a
6 4 X 6 cm square cut away, to serve as an assessment area.
7 The assessment area could be easily viewed through the
8 enclosure. The landing rate of the mosquitoes, and
9 behaviour, was observed for a period of 5 minutes.
10 Following the control test, one of the compositions being
11 tested was applied to the exposed area of skin and
12 allowed to dry for 10 minutes, as all products tested
13 were aqueous solutions, and thus a period was required to
14 allow the composition to dry on the skin. The procedure
15 was then repeated for the treated hand.

16
17 Five commercially available repellents were compared to
18 the composition of the present invention. Two of the
19 five were synthetic DEET based products. The third
20 repellent contained the active ingredient of citronella,
21 in order to allow comparison of the repellency of the
22 composition of the present Application with citronella.
23 The fourth repellent was neem based, with concentrated
24 solutions of eucalyptus, bergamot and rosemary, and
25 allowed comparison of the repellency of the composition
26 of the present Application with neem oil. A fifth
27 product, a cosmetic moisturiser containing citronella was
28 also tested.

29

30 Figure 1 illustrates the comparative efficacy of the
31 compositions tested. Percentage repellency was
32 calculated using:

33

$$\frac{100 - \text{no of bites on treated hand} \times 100}{\text{no of bites on control hand}}$$

As expected the two DEET based treatments showed the greatest repellency. However whilst these products have excellent repellency (inducing on average 84.7% and 84.6% reduction in mosquito landings) the disadvantages of these products (toxicity, high skin absorption, unpleasant smell are well documented.

The fifth repellent (neem based, with concentrated extracts of eucalyptus, bergamot and rosemary) provided the least protection from mosquito landing and in some cases failed to reduce landing rates at all. The fourth repellent, a cosmetic moisturiser reputed to have repellent properties and containing citronella, provided more protection (an average of 57.6% reduction) but was short-lived, and it is thought that the mosquitoes were temporarily repelled by the perfume component of this product. The third citronella based repellent was more effective, providing a 62% reduction in mosquito landings. However in the tests the composition of the present Application induced the closest effects to the DEET products - reducing mosquito landings by 70.6% - an additional 30% over the Neem oil based product (repellent No 5). Accordingly the composition of the present Application, which consists of a combination of essential oils, has a surprisingly synergistic effect over existing commercially available products containing these essential oils.

In addition to counting the number of landings/bites, observations of the behavioural changes in the test

1 mosquitoes were made. This was done in order to
2 determine where any of the compositions being tested
3 modified or inhibited the normal mosquito behaviour.

4
5 When exposed to the DEET based repellents a dramatic
6 change was observed in the mosquito behaviour - namely
7 that activity levels fell greatly. Flight activity was
8 reduced and many of the mosquitoes were observed to rest
9 on the surface of the enclosure. In addition the
10 mosquitoes displayed excessive cleaning, in some cases
11 frantic cleaning of the antenna, and extensive cleaning
12 of the proboscis, wings and appendages. This behavioural
13 response was noticed most in male mosquitoes. These
14 behavioural responses were not observed when the
15 remaining three commercially available, and natural based
16 compositions were tested, i.e. the citronella based
17 repellent, cosmetic citronella based moisturiser, and the
18 neem oil with extracts of eucalyptus, rosemary and
19 bergamot) based repellent.

20
21 However, when tested, and surprisingly, the composition
22 of the present invention elicited the same behavioural
23 responses as the DEET products - i.e. inactivity and
24 excessive cleaning. In addition the mosquitoes displayed
25 irregular body movements and incoordination - many of the
26 mosquitoes showed inability to retain grip on the
27 enclosure walls. This was surprising as behavioural
28 changes were not observed with the three natural based
29 commercially available repellents. Prior to testing it
30 was expected that behaviour of the insects when exposed
31 to the composition of the present invention would be
32 closer to the behaviour elicited by these other natural
33 repellents, and not, as actually occurred in the testing,

1 the synthetic DEET products. It has been postulated that
2 the observed inability to co-ordinate movement is a
3 result of highly oxidised azadirachtin molecules (the
4 active ingredient of the neem oil in the present
5 composition) targeting the nervous system of the insects
6 and disrupting ganglionic processes. Nevertheless these
7 behavioural changes were not observed with the
8 commercially available neem based product. These results
9 suggest the composition of the present invention is
10 substantially more effective at curtailing insect or
11 mosquito attack than existing natural products, as it
12 induces a lack of activity and incoordination in the
13 mosquitoes, thus preventing biting, in a similar manner
14 to synthetic DEET based repellents.

15
16 After exposure to the composition of the present
17 invention, the alteration in the mosquitoes behaviour was
18 observed to last for many hours. However after 24 hours
19 all symptoms had disappeared, leaving no apparent lasting
20 damage to the insects.

21
22 The composition herein described has been shown to have a
23 substantially greater efficacy at repelling insects than
24 existing commercially available natural oil based
25 repellents. In particular the composition which consists
26 of a mixture of lime oil, myrtle, citronella oil,
27 eucalyptus oil and neem oil, has been shown to have a
28 surprisingly greater efficacy at repelling insects than
29 commercially available citronella or neem based
30 repellents. The composition of the present invention,
31 has an efficacy close to synthetic DEET products and
32 elicits a behavioural response in mosquitoes very similar
33 to DEET, but which is not produced by existing natural

1 oil based repellents. Although the present composition
2 has been shown to have a similar efficacy to DEET, it has
3 inherent advantages over this synthetic repellent, as it
4 has no toxic side-effects, and has a pleasant smell.

5

6 Modifications and improvements may be made to the
7 foregoing without departing from the scope of the
8 invention.